Migration of raptors across the Bab el Mandeb Strait, Djibouti, March 2013

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Migration de rapaces au-dessus du Détroit de Bab-el-Mandeb, Djibouti, mars 2013. Du 2 au 10 mars 2013, 4,562 rapaces en migration ont été recensés au-dessus du Détroit de Bab-el-Mandeb. L'Aigle botté *Hieraaetus pennatus* et le Percnoptère d'Égypte *Neophron percnopterus* étaient les espèces les plus nombreuses, représentant respectivement 53.9% et 35.5% des migrateurs identifiés. Les Percnoptères d'Égypte étaient tous des adultes, sauf trois individus estimés âgés de trois ans. La fréquence des passages était la plus élevée entre 08.00 et10.00 h et la migration visible cessait vers midi, les oiseaux volant alors plus haut et la voie de migration se déplaçant apparemment vers le sud. À cause du fait que la voie de migration semblait se déplacer au cours de la journée et que les rapaces volaient très haut, les résultats des comptages représentent des valeurs minimales. Il serait possible d'améliorer le suivi des oiseaux migrateurs à Djibouti, d'y promouvoir la protection de la nature et d'y développer l'observation des oiseaux, en particulier des rapaces.

Summary. During 2–10 March 2013, 4,562 raptors were recorded migrating across the Bab el Mandeb Strait. Booted Eagles *Hieraaetus pennatus* and Egyptian Vultures *Neophron percnopterus* were the most numerous migrants, accounting for 53.9% and 35.5% of the migrants identified to species level, respectively. Among the migrating Egyptian Vultures, all were adults apart from three birds judged to be three-year olds. Migration rates were greatest during 08.00–10.00 hrs, and visible migration ceased by noon due to birds soaring higher and an apparent shift in the migration path to the south. Because the migration path appeared to move as the day passed and raptors migrated at high elevations, our counts represent minima. Opportunities exist in Djibouti to enhance monitoring of migrant soaring birds, promote conservation and develop birdwatching, especially raptor watching.

The Eurasian–East African Flyway is the second-most important flyway for migrant soaring birds in the world. Coincidental along much of the flyway's path is the Great Rift Valley, which reaches its most northerly point in Jordan, includes the Red Sea, then extends south in Africa from Djibouti, Eritrea and Somalia to Mozambique. The Bab el Mandeb Strait, which separates Yemen from Djibouti, represents an important bottleneck along the route, and marks the closest point between Arabia and Africa south of Suez. Over 1.5 million soaring birds of 37 species (including five globally threatened species) move between Eurasia and Africa each year (BirdLife International 2013a), and Suez and the Bab el Mandeb are locations where the migration concentrates and large numbers of migrants can be observed. Despite its importance, the migration at the Bab el Mandeb Strait has been little studied; the majority of the available counts were made more than 20 years ago, most of them in autumn (Shirihai *et al.* 2000). These studies revealed that the Bab el Mandeb Strait is an important bottleneck site (Fishpool & Evans 2001) and that the species composition of the migration is seasonally different. More than 246,000 raptors of 28 species have been recorded crossing in a single autumn (1987), mostly Steppe Buzzards *Buteo buteo vulpinus* and Steppe Eagles *Aquila nipalensis* (Welch & Welch 1988). In spring, past field work has been limited to just three days in a single year on the Djibouti side (Welch & Welch 1991) and four days in 1998 on the Yemen side of the strait (Welch & Welch 1999a). In both years, large numbers of Booted Eagles *Hieraaetus pennatus* and Egyptian Vultures *Neophron percnopterus* predominated the count totals of raptors moving north (Welch & Welch 1991).

We studied the migration of raptors at the Bab el Mandeb during nine days in March 2013. We aimed to address some of the recommendations made in a report to IUCN and the Djibouti government (Welch & Welch 1999b), and confirm the importance of the spring migration, especially for Egyptian Vulture, a species that is currently considered globally Endangered (BirdLife International 2013b). With these data we hoped to create the early foundations for more

Figure 1. Ras Siyyan, a volcanic cone on the Djibouti coast, the western boundary of the Bab el Mandeb Strait (M. J. McGrady)

Ras Siyyan, un cône volcanique sur la côte de Djibouti, la limite occidentale du Détroit de Bab-el-Mandeb (M. J. McGrady)

work on the migration in Djibouti, and explore the possibility that counts at the strait may aid in monitoring the population of Egyptian Vultures that nest north of Africa and thereby support its conservation. Obviously, more information on the importance of the strait to migrants could support site protection efforts and highlight the importance of targeted conservation efforts in the area nearby.

Counts of migrating raptors in other parts of the world have been used to monitor populations (Farmer *et al.* 2007), as well as providing information useful to public conservation education efforts. Also, raptor watching (e.g. http://mnsraptorwatch.wordpress.com/sponsors-and-supporters/) and birdwatching in general (e.g. Puhakka *et al.* 2011), can provide tourism opportunities that promote conservation and provide local job opportunities.

Materials and methods

We attempted to count as many migrating raptors as possible on the Djibouti side of the Bab el Mandeb each day during 2–10 March 2013. Observations were made using 8× and 10× binoculars and 20–60× spotting telescopes. Birds were identified to species and aged whenever possible, using Porter *et al.* (1981), Clark & Schmitt (1998), Clark (1999) and Forsman (1999). HR & MM are experienced observers of raptor migration. Most of HR's experience is in Djibouti; MM has experience in Israel (particularly relevant because the species encountered there include those observed during this study), Europe, Asia, North and Central America. AD & EA were novices, but were always teamed with experienced observers during counts, in most cases teams comprised one experienced and one novice observer.

Over the course of the field work we also sought the best location for making migration observations, and thus searched for places where the migration concentrated, including points of departure (on the Djibouti coast) for migrants heading to Yemen.

During 2–5 March our counts were made from three locations near Ras Siyyan (VP1: 12°28'45"N 43°18'47"E; VP2: 12°28'34"N 43°19'04.5"E; VP3: 12°28'12"N 43°19'19"E). Ras Siyyan is a small volcanic cone located on the northern Djibouti coast (Fig. 1). It, along with six small volcanic islands, form the 'Les Sept Frères' Important Bird Area (IBA). Ras Siyyan is a distinctive landmark on the western border of the Bab el Mandeb Strait and forms that part of the Djibouti mainland closest to Yemen. During 6–10 March observers were stationed at VP2 and at 12°25'25"N 43°17'00"E (VP4) and 12°23'51"N 43°17'02"E (VP5) (see Fig. 2). The locations of VP4 and VP5 were suggested by our observations from Ras Siyyan of distant groups of raptors rising above terrain features after the migration volume at Ras Siyyan had decreased. During 6–10 March, as the volume of migration decreased during the morning, the observers quit their locations and searched as a single team for

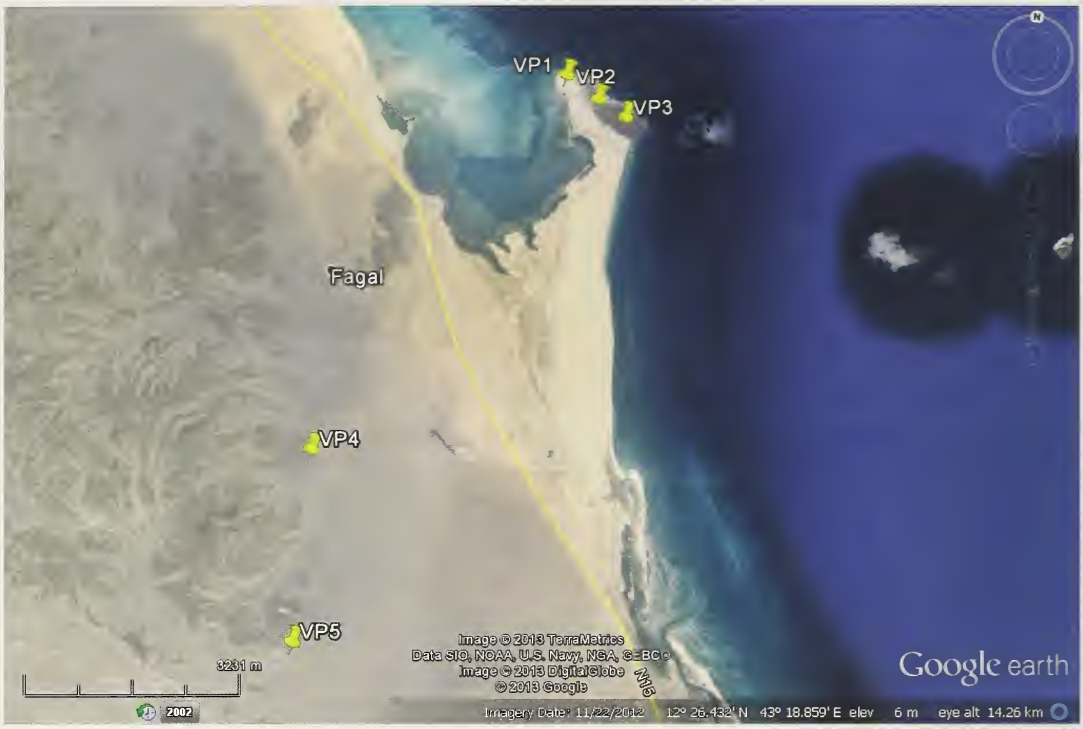

Figure 2. Locations of vantage points from which observations were made (satellite image courtesy of Google Inc. All rights reserved © © 2013 DigitalGlobe).

Emplacement des points de vue utilisés pour les observations (image satellitaire avec la permission de Google Inc. Tous droits réservés © © 2013 DigitalGlobe).

the migration path. Searches were made south to the 'Godoria plateau', which is on the coast *c.*25 km south of Ras Siyyan and rises to *c.*250 m above sea level (Fig. 3). We also searched inland (west) from Ras Siyyan to the village of Lahasa (*c.*20 km).

Counts were recorded in time blocks (08.00–10.00, 10.01–12.00, 12.01–14.00, 14.01–16.00), and counts from different observation points were rationalised at the end of each day to ensure that double-counting was minimised. General weather conditions were recorded, including temperature, percent cloud cover, wind direction and strength (Beaufort scale).

Results

Weather

During our study, the weather was dry throughout and hot during the daytime (temperatures ranged between 20°C early in the morning to the upper 30s at midday). The wind was moderate or strong on all days, sometimes gusting, north-easterly to easterly. Clouds were high and coverage varied from <5% to 80%, but was very changeable in the strong winds. Especially during late morning, soaring birds would disappear into the high clouds, making counting difficult. At times there was haze, dust and heat shimmer that impeded making distant observations.

Numbers and composition

Formal migration watches were made for a total of 46.5 hours, and total effort was 168 man-hours. Table 1 summarises the daily counts. A total of 4,562 raptors was recorded (mean daily count = 141.3; SD=388.0). Booted Eagle and Egyptian Vulture were the most numerous species and comprised a minimum of 38.9% and 25.6% of the total, respectively. Some 27.9% of the raptors that were seen could not be identified to species level because they were too distant or visibility was not ideal. However, flight profiles suggested to us that a large percentage of these were either Booted Eagles or Egyptian Vultures. Of birds that could be identified to species, Booted Eagle and Egyptian Vulture comprised 53.9% and 35.5%

Figure 3. View from the Godoria plateau, looking north toward Ras Siyyan, which is *c.*25 km distant, and invisible due to haze (M. J. McGrady)

Vue vers le nord à partir du plateau Godoria vers Ras Siyyan, qui se trouve à environ 25 km et est invisible à cause de la brume (M. J. McGrady)

Table 1. Counts of the visible raptor migration over the Bab el Mandeb Strait, Djibouti, 2–10 March 2013.

Tableau 1. Recensements de la migration visible de rapaces au-dessus du Détroit de Bab-el-Mandeb, Djibouti, 2–10 mars 2013.

	2 Mar	3 Mar	4 Mar	5 Mar	6 Mar	7 Mar	8 Mar	9 Mar	10 Mar	TOTAL	%
Booted Eagle *Hieraaetus pennatus*	37	166	271	67	55	315	276	369	217	1,773	38.86
Egyptian Vulture *Neophron percnopterus*	29	84	233	15	73	71	309	158	195	1,167	25.58
Short-toed Snake Eagle *Circaetus gallicus*	0	0	5	11	5	6	66	64	69	226	4.95
Steppe Eagle *Aquila nipalensis*	2	2	4	7	0	8	17	29	7	76	1.67
European Honey Buzzard *Pernis apivorus*	1	1	4	4	0	4	5	0	2	21	0.46
Imperial Eagle *Aquila heliaca*	1	1	0	1	0	0	3	0	2	8	0.18
Bonelli's Eagle *Aquila fasciata*	0	0	0	0	0	2	2	0	0	4	0.09
Common Kestrel *Falco tinnunculus*	0	1	1	0	0	1	0	0	0	3	0.07
Lesser Spotted Eagle *Clanga pomarina*	3	0	0	0	0	0	0	0	0	3	0.07
Long-legged Buzzard *Buteo rufinus*	0	0	2	0	0	0	0	0	0	2	0.04
Lanner Falcon *Falco biarmicus*	1	0	0	0	0	1	0	0	0	2	0.04
Shikra *Accipiter badius*	1	0	0	0	0	1	0	0	0	2	0.04
Pallid Harrier *Circus macrourus*	0	0	0	0	0	0	1	0	0	1	0.02
Western Marsh Harrier *Circus aeruginosus*	0	1	0	0	0	0	0	0	0	1	0.02
Unidentified falcons *Falco* sp.	0	0	0	0	0	0	0	0	1	1	0.02
Unidentified raptors (most probably Booted Eagle and Egyptian Vulture)	3	21	105	50	3	81	526	311	172	1,272	27.88
TOTALS	78	277	625	155	136	490	1,205	931	665	4,562	

Table 2. Rate of migration (birds per hour) per two-hour time blocks for Booted Eagle *Hieraaetus pennatus* and Egyptian Vulture *Neophron percnopterus* at the Bab el Mandeb Strait, Djibouti, 2–10 March 2013 (*n* = hours of observation within time block)

Tableau 2. Fréquence de passage (oiseaux par heure) par blocs de deux heures pour l'Aigle botté *Hieraaetus pennatus* et le Percnoptère d'Égypte *Neophron percnopterus* au Détroit de Bab-el-Mandeb, Djibouti, 2–10 mars 2013 (*n* = heures d'observation à l'intérieur du bloc)

	Time of day				
	08.00–10.00 (*n*=72)	10.00–12.00 (*n*=72)	12.00–14.00 (*n*=18)	14.00–16.00 (*n*=17)	16.00–18.00 (*n*=8)
Booted Eagle *Hieraaetus pennatus*	14.9	9.13	0.4	1.8	0.6
Egyptian Vulture *Neophron percnopterus*	13.8	2.4	0.1	0.2	0.0

of the count, respectively. Only three non-adult Egyptian Vultures were recorded; all were judged to be three years of age. Booted Eagles comprised an approximately equal number of dark and pale colour morphs.

Daily movement of migration path

On most days migration started between 08.30 and 09.00 hrs. The earliest records were at 08.00 (6 March). Egyptian Vultures were the first species observed every day at Ras Siyyan, migrating singly or in small groups. At inland watchpoints Booted Eagles were the first species observed daily. Early in the morning the migration arrived at Ras Siyyan exclusively from the west (i.e. no birds were seen migrating along the coast from the north or south). Later in the morning the migration moved south along a path inland from the coast, and visible to us *c.*1–2 km from the coastline. The rate of migration was highest at 08.00–10.00 hrs for Booted Eagles and Egyptian Vultures, after which the rates declined; after 12.00 hrs virtually no migration was visible from Ras Siyyan or our other observation locations (Table 2).

The location of the point of departure from Djibouti towards Yemen appeared to change during the day. Early in the day (up to *c.*10.00 hrs), Ras Siyyan was an important departure point. However, as the morning progressed (starting between 09.30 and 10.30 hrs) steadily increasing numbers of birds that arrived at Ras Siyyan from the west did not cross the strait, but turned south along the coast or moved south-west toward inland hills, where they gained altitude and disappeared from view, moving up and south. We searched unsuccessfully for a place where the migration concentrated after 10.00 hrs and birds departed Djibouti across the sea. We visited the Godoria plateau on three separate days (4, 7, 10 March) in the early afternoon. Only on 10 March did we witness any migration there, and on that day birds were still moving south along the coast and apparently not departing towards Arabia.

Discussion

We recorded a total of 4,562 migrating raptors of 14 species during nine days. The migration moved south as the morning progressed, and it gained altitude as temperatures increased, so these numbers represent only a proportion of the total migration that occurred during the period between Africa and Arabia.

Our findings confirm those of Welch & Welch (1991): (1) a significant migration of raptors occurs in spring over the Bab el Mandeb; (2) migration is most visible in the morning; (3) Egyptian Vultures and Booted Eagles are by far the commonest migrants; (4) Steppe Eagles and Steppe Buzzards do not feature importantly in the migration across the Bab el Mandeb in early March; and (5) the migration appears to shift south from the point where the strait is narrowest (Ras Siyyan) as the morning progresses and temperatures rise. Our observations also demonstrate that the importance of the site has not diminished despite the passage of time and the apparent erosion of the global conservation status of Egyptian Vultures.

Welch & Welch (1991) made their observations over just three days during unusual weather (overcast and hazy), and therefore were unsure if their findings were representative. Our observations during 2–6 March were made during unusually strong winds (according to local people) from the north-east and east, which probably also affected our counts, although they do not contradict the findings of Welch & Welch (1991). We recorded a greater variety of species than Welch & Welch (1991), most certainly due in

part to the longer duration of our study and perhaps the different weather conditions.

It is our opinion that a very large proportion of the birds that were too distant to identify (almost 28% of all migrants seen) were eagles, probably Booted Eagles, and Egyptian Vultures because of their size and because the composition of the identifiable migration did not seem to change greatly over the course of the day. The few birds that were seen in the afternoons were almost always Booted Eagles or Egyptian Vultures.

The importance of the Bab el Mandeb for both Booted Eagles and Egyptian Vultures on migration is highlighted by the results of counts of migrant soaring birds made in spring 2012 at a bottleneck in the northern Red Sea. There, over 63 days of observation, 1,128 Egyptian Vultures and 1,177 Booted Eagles were counted (total migration = 183,275 birds) (Megalli & Hilgerloh 2013).

Generally, counts after 5 March were larger than those before that date. We do not know whether this was due to changes in our vantage points, different weather, a change in the volume of migration or some combination of these factors. Therefore, we do not know if our observations coincided with the peak migration. More work is needed to clarify this, but during a subsequent visit to Ras Siyyan on 19 March 2013, 1,861 migratory soaring birds, including 459 migrating Egyptian Vultures and 900 Booted Eagles, were recorded during just two hours (H. Rayaleh pers. obs.).

Unless there is a separate spring migration route for non-adult Egyptian Vultures, the age composition of birds that we recorded supports the idea that immatures from migratory populations in Asia and Europe remain well south of the breeding areas (Yosef & Alon 1997, Mundy *et al.* 1999), although subadults are also observed on northern breeding grounds (e.g. Stoynov *et al.* 2013).

We witnessed an apparent shift of the migration to the south as the morning progressed that coincided with the decline in numbers of migrants counted, but we were surprised not to then witness a stream of migrants over the Godoria plateau heading toward Yemen. The plateau is the only prominent topographic features on the coast south of Ras Siyyan and could provide uplift to facilitate the crossing. Welch & Welch (1991) thought that the decline in numbers of raptors seen crossing the strait as the day progressed was due to the migration gaining altitude over inland hills after mid morning and moving south, thereafter being unobservable at the strait. Our observations generally support this suggestion, but unlike the previous study we were unable to relocate the migration path further south, perhaps due to the unusually strong wind conditions.

Like Welch & Welch (1991), we observed no Steppe Buzzards and few Steppe Eagles, although these species comprise large proportions of the migration observed further north and their winter ranges include areas south of Djibouti. Both of these species are recorded at Eilat, in southern Israel, in large numbers after early March (e.g. Leshem & Yom-Tov 1996) and so theoretically should be migrating at the latitude of Djibouti at the time our observations were made. Although neither we nor Welch & Welch (1991, 1999a) observed many Steppe Eagles or Steppe Buzzards in spring, it is impossible to categorically state that no significant passages of these species occur over the strait because the total number of observation days is small. In the case of Steppe Eagles, satellite tracking suggests that most individuals move north via Suez in spring (Meyburg *et al.* 2003, 2012), but these data are from a small number of individuals. It is interesting to note that Steppe Buzzards and Steppe Eagles do apparently form a major component of the autumn soaring bird migration over the strait (Welch & Welch 1988).

Our observation of three Lesser Spotted Eagles *Clanga pomarina* is unexpected. This species is easily confused with both Steppe Eagle and Greater Spotted Eagle *C. clanga*, and all are quite variable in plumage. The main distinguishing feature that we used was the barring of the remiges, which also indicates that the individuals were not adults. Although we are reasonably confident that these birds were correctly identified because all were seen at relatively close range by both of the experienced observers, we accept that this is a difficult species to reliably identify, and no comparison with other species was possible. Welch & Welch did not record this species at Bab el Mandeb in spring (1991), but saw a few during autumn counts (1988).

While this work has demonstrated that a large number of Booted Eagles use the Bab el Mandeb during their spring migration, it is

important to focus on Egyptian Vultures because of their poor and deteriorating conservation status. Raptors, particularly vultures, face a wide array of conservation challenges globally. In Africa targeted and inadvertent poisoning, intentional shooting, use for bushmeat and in traditional medicine, and electrocution and collision with utility infrastructure are just some of the threats that face vultures. Vultures provide important ecosystem services, some of which can directly benefit human health. Consequences of reductions in vulture populations can include greater risk of disease and increases in populations of other scavengers, including feral dogs (Markandya *et al.* 2008).

Threats to vultures vary across regions / countries in Africa. In Sudan shooting appears to be relatively common, the use of vultures for bushmeat or traditional medicine is more common in West Africa, and poisoning of vultures appears most common in countries where poaching of big game animals occurs and where pastoralists / farmers seek to control mammalian predators. Along some of the Red Sea coast, wind farm developments and power transmission infrastructure are potential threats to vultures and other soaring birds (Angelov *et al.* 2012). The environment for vultures in Djibouti appears to be more benign than elsewhere in Africa. Factors that might affect this include low levels of agriculture or herding, a relatively small and mostly unarmed human population that is concentrated in the capital city, and low levels of poaching. There are very few conservation efforts being pursued in Djibouti.

Djibouti is a small, politically stable, relatively safe and logistically 'easy' to visit country that offers opportunities to support Egyptian Vulture conservation in a number of ways. As an important migration bottleneck, the Bab el Mandeb can be used to monitor population trends (not numbers) of breeders from further north, especially if more is learned about how the migration path varies as the day progresses and long-term annual migration monitoring is established. However, in the case of Egyptian Vultures that use the Bab el Mandeb in spring, the immediate conservation value of counts is lessened by the difficulty of linking these to population size and the lack of long-term data. In terms of conservation, what is probably more important is to ensure that shooting and poisoning of migrants do not become common activities in Djibouti. While such persecution would obviously have a negative effect on any species, in the case of Egyptian Vultures the effect would probably be greater because of the age composition of the migration in Djibouti; we know that increased adult mortality (especially in a long-lived, delayed-maturity species like Egyptian Vulture) has the greatest effect on population size because it impacts numbers both directly and through decreased annual productivity (Mertz 1971, Stahl & Oli 2006). Also, it is important that any power generation and transmission infrastructure in the area is located sensitively and designed with migrating soaring and other birds in mind (Angelov *et al.* 2012). As a country in which Egyptian Vultures appear to be relatively safe, opportunities exist to better understand the ecology of resident birds, the ecology of young birds that will eventually seek to breed further north, and the non-breeding season ecology of breeding-aged birds from further north, and use any resultant data to better support conservation of the species across its range. Also, opportunities exist to promote conservation of vultures and other migrant soaring birds through eco-tourism (tourism of any type is under-developed in Djibouti) and public education. Egyptian Vultures may be a particularly appropriate flagship species for conservation in Djibouti because they are commensal with humans, even in very small and remote settlements, and so many people in small towns and rural areas are familiar with the species.

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